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Asbestos Bodies and Fibers in Lung Tissues

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It is suggested that the ratio of asbestos bodies observable by light microscopy to asbestos fibers counted by electron microscopy be examined in a series of cases of asbestosis of varying severity. If the ratio is reasonably constant an estimate of fiber content could be made from the more easily conducted count of asbestos bodies by light microscopy.

At Le Havre we see many workers with heavy exposure to asbestos. Like other investigators, we find ferruginous bodies and uncoated fibers in the sputum and in the lung tissue. We need information on the number of fibers and their significance. Unfortunately, light microscopy is inadequate for the counting of uncoated fibers, and electron microscopy is a time-consuming technique. What we propose provides a possible way of escaping from this dilemma.

Our material was taken from 14 cases of pleural mesothelioma and 11 cases of severe occupational asbestosis with lung fibrosis and squamous carcinoma. Our control material was taken from 52 unselected patients from the general population.

Our procedure involves taking 4 g of lung tissue from the lower lobes. This is subjected to alkaline digestion and the residue is washed and centrifuged. A small drop of the final suspension is allowed to dry on a Formvar-coated grid for electron microscopy. The rest of the sample is concentrated on a Millipore membrane.

With light microscopy we find that all of our unselected patients have a few asbestos bodies. In severe asbestosis we observe many thousand bodies. The cases of mesothelioma lie somewhere in between these two groups. The relative numbers of asbestos bodies found are given in Table 1.

By electron microscopy we observed many uncoated asbestos fibers in all of our cases. In six patients with severe asbestosis we counted a hundred or more fibers for every asbestos body, as indicated in Table 2.

Table 1.

Group	No. Total	Number of ferruginous bodies in 4 g lung by light microscopy: $0 - 10^2$	$10^2 - 10^3$	$10^3 - 10^4$	$10^4 - 10^5$
Unselected patients	52	48	4	—	—
Mesothelioma patients	14	4	4	5	1
Severe asbestosis patients	11	—	—	3	8

Table 2.

Case No.	Number in 4 g of lung tissue: Asbestos bodies by light microscopy	Uncoated fibers by electron microscopy
30.606	11×10^4	12×10^6
A. 481	69×10^4	30×10^6
A. 691	1.5×10^4	3.0×10^6
A. 1384	47×10^4	13.5×10^6
A. 382	11×10^4	16×10^6
A. 1154	22×10^4	31×10^6

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If this ratio is relatively constant for various degrees of asbestosis from mild to severe, then the count of asbestos bodies by light microscopy, which can be done relatively rapidly, would provide an estimate of the number of fibers present.

It was surprising to us to find that, in the lung tissue of our patients with high exposure to both amphiboles and chrysotile, the fibers present are almost exclusively large amphibole fibers, with only rare very long and sinuous chrysotile fibers.

On the other hand, when we studied pleural plaques in the same way (in the same cases of asbestosis or on the side contralateral to a mesothelioma), we also found asbestos fibers, but these were smaller and thinner (less than 2 μm in length), and we commonly saw chrysotile fibers with their characteristic shape and electron diffraction pattern.

I might add that, only recently I saw a case in which there was not only lung fibrosis, a squamous carcinoma of the lung, and pleural plaques, but also a curious hyaline plaque on the liver in which there were a few asbestos bodies and small uncoated fibers of both amphibole and chrysotile.

In conclusion, it may be of interest to quantitate the ratio of asbestos bodies to asbestos fibers in human lungs because it would easier and less time-consuming for screening to count asbestos bodies in light microscopy than in electron microscopy.